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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/881,299	06/13/2001	Dinesh Chopra	MI22-1747	7028

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EXAMINER

CAO, PHAT X

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 06/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/881,299

Applicant(s)

CHOPRA ET AL.

Examiner

Phat X. Cao

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 March 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 47-62 is/are pending in the application.
- 4a) Of the above claim(s) 55-58 and 61 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 47-54, 59, 60 and 62 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 13.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION

Election/Restriction

1. Newly amended claims 55-58 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: the newly submitted claims 55-58 and 61 are directed to an integrated circuit having the alloy material layer of Al-Pd formed within the Al layer. And the original claims are directed to an integrated circuit having the alloy material of Cu-Pd formed within the Cu layer.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 55-58 and 61 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 47-54, 59-60 and 62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tobben et al (US. 6,261,950) in view of Obeng et al (US. 6,323,131).

Tobben (Fig. 8) discloses an integrated circuit comprising: a semiconductor substrate 204; a layer 206 consisting of copper over the substrate; a layer of alloy material 212 within the copper layer, the alloy material layer 212 comprising intermetallic Cu(3)Ti or MgCu(2) (column 5, lines 38-45) and having a thickness of between about 300 to about 500 angstroms (column 5, lines 53-54); and a conductive connection 226 on the alloy layer 212 (see Fig. 9).

Tobben discloses the alloy material layer comprising Cu(3)Ti or MgCu(2), but does not disclose the alloy material layer comprising Cu(3)Pd.

However, Obeng teaches the forming of the alloy material within the layer comprising Cu, the alloy material layer comprising Cu(3)Ti or Cu(3)Pd (column 1, lines 32-40). Accordingly, it would have been obvious to alloy the copper surface to form the alloy material layer of either Cu(3)Ti or Cu(3)Pd. According to Obeng, such forming of those alloy material layers is well known in the art for preventing the copper surface from the air oxidation (column 1, lines 32-40). It also would have been obvious to reduce the thickness of the intermetallic layer 212 of Tobben from 300 angstroms to 150 angstroms as claimed because it appears that these changes produce no functional differences and therefore would have been obvious. See in re Woodruff, 919 F. 2d 1575, 1578, 16 USPQ 2d 1934, 1936 (Fed. Cir. 1990).

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4. Claims 47-54, 59-60 and 62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chan et al (US. 6,468,906).

Chan (Fig. 2K) discloses an integrated circuit comprising: a semiconductor substrate 12 (not shown, see Fig. 2); a layer 56 consisting of copper over the substrate; a layer of alloy material 61 within the copper layer, the alloy material layer 61 comprising intermetallic Cu-Pd (column 4, lines 57-62); and a conductive connection 68 on the alloy layer 61.

Chan also discloses the forming of the intermetallic cap layer having a thickness of from about 50 to about 300 angstroms (column 6, lines 5-9) and formed within the layer comprising copper (see Fig. 3D). Accordingly, it would have been obvious to form the intermetallic cap layer with the thickness as set forth above because according to Chan, such thickness of the intermetallic cap layer would provide a good adhesion and diffusion barrier (column 5, lines 33-34).

Response to Arguments

5. With respect to the combination of Tobben and Obeng, Applicant argues that the claimed thickness is clearly more advantageous than the Tobben thickness because the intermetallic layer thickness of 150 angstroms will not have a functional equivalent with the intermetallic layer thickness of 300 angstroms.

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Applicant's arguments are not persuasive because there is no evidence of record which indicates that these two different thicknesses of the intermetallic layer will not have a functional equivalent. In contrast, Applicant's specification (pages 8 and 9) states that within the broader range of about 50 to about 300 angstroms, the intermetallic material layer acts as a barrier layer for reducing oxidation of the layer comprising copper. Therefore, two different thicknesses of 150 and 300 angstroms within the range of 50 to 300 angstroms would perform a functional equivalent of reducing oxidation of the layer comprising copper.

Furthermore, according to Applicant (page 7 of remark), the thickness of the intermetallic material (i.e., 50-300 angstroms) can be optimized depending on the application of the invention. In the other words, the thickness of the intermetallic material for reducing oxidation of the layer comprising copper is not critical. Therefore, it would have been obvious because it has been held that where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. *In Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), Cert. Denied, 469 U.S. 830, 225 USPQ 232 (1984).

With respect to Chan, Applicant argues that the alloy layer 61 (Fig. 2K) of copper-palladium is not an intermetallic material.

Applicant's arguments are not persuasive because the alloy layer 61 of copper-palladium is an intermetallic material. Specifically, Chan (column 4, lines 56-62) teaches that the alloy

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layer 61 is formed by the reaction at the interface between the copper layer 56 and the palladium (Pd) passivation layer 59 after annealing of the device 50. Moreover, these claims are directed to the product, no matter how it is actually made, and the patentability of the final product must be determined, not the patentability of the process, which in any case have not been presented in "product by process" claims. In this case, the final structure of the claimed alloy intermediate layer would not distinguish over the prior art alloy intermediate layer.

Applicant further argues that metal barrier layer 91 of palladium shown in Fig. 3D is electroless plated and is not an intermetallic material.

Applicant's arguments are not persuasive because Fig. 2F is relied on for teaching the forming of an intermetallic copper-palladium, but not Fig. 3D. Fig. 3D is only relied on for teaching the known feature of forming the cap layer having the thickness in the range as claimed for providing a good adhesion and diffusion barrier.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

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will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is (703) 308-4917. The Examiner can normally be reached on Monday through Thursday. If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Wael Fahmy, can be reached on (703) 308-4918.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0956. Group 2800 fax number is (703) 308-7722 or (703) 308-7724.

PC
May 30, 2003



PHAT X. CAO
PRIMARY EXAMINER